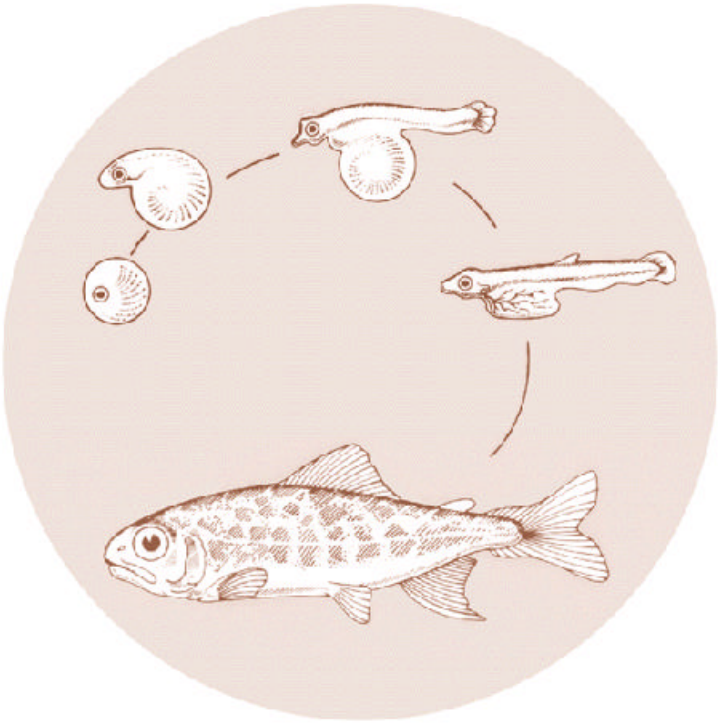
May 1996

HATCHERY EVALUATION REPORT
BONNEVILLE HATCHERY
TULE FALL CHINOOK

An Independent Audit Based on Integrated Hatchery Operations Team (IHOT) Performance Measures



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HATCHERY EVALUATION REPORT

BONNEVILLE HATCHERY - TULE FALL CHINOOK

An Independent Audit Based on Integrated Hatchery Operations Team

(IHOT) Performance Measures

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Section 1

Executive Summary

This report presents the findings of the independent audit of the Bonneville Hatchery (Tule Fall Chinook). The hatchery is located on the Columbia River just west of Cascade Locks, Oregon. The hatchery is used for adult collection, egg incubation, and rearing of Tule Fall Chinook and URB Fall Chinook.

The audit was conducted in April 1996 as part of a two-year effort that will include 67 hatcheries and satellite facilities located on the Columbia and Snake River system in Idaho, Oregon, and Washington. The hatchery operating agencies include the U.S Fish and Wildlife Service, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, and Washington Department of Fish and Wildlife.

Background

The audit is being conducted as a requirement of the Northwest Power Planning Council (NPPC) ÒStrategy for SalmonÓ and the Columbia River Basin Fish and Wildlife Program. Under the audit, the hatcheries are evaluated against policies and related performance measures developed by the Integrated Hatchery Operations Team (IHOT). IHOT is a multi-agency group established by the NPPC to direct the development of new basinwide standards for managing and operating fish hatcheries. The Bonneville Power Administration (BPA) contracted with Montgomery Watson to act as an independent contractor for the audit.

IHOT has established five basic policies that cover: (1) hatchery coordination, (2) hatchery performance standards, (3) fish health, (4) ecological interaction, and (5) genetics. The audit focuses on all these policies, with the exception of hatchery coordination. These policies are set forth in *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries (IHOT 1995).* That document is the source for the performance measures that are the basis of this audit.

The Audit Process

The audit was based on the facility managementÕs response to a 98-page questionnaire. This audit form was completed through a five-step process in which:

- Information was obtained from headquarters sources

- The hatchery manager was asked to fill out and return the audit form

- A 1-2 day site audit inspection visit was conducted to inspect facilities, review hatchery records, discuss audit form responses, and develop remedial action plans

- A compliance report was developed to document the compliance status of each performance measure. This report was then shared with the hatchery manager and IHOT representative.

- This hatchery evaluation report was written to document compliance with IHOT performance measures and develop cost estimates for remedial actions when needed.

Bonneville Hatchery (Tule Fall Chinook) Audit Results

The Bonneville Hatchery facility includes 4 adult holding ponds, 30 converted Burrows ponds, 30 raceways, and incubation facilities. Bonneville Hatchery was constructed in 1909 and was originally funded by the State of Oregon. In 1957 the facility was remodeled and expanded as part of the Columbia River Fisheries Development Program (Mitchell Act), a program to enhance declining fish runs in the Columbia River Basin. The hatchery underwent another renovation in 1974 as part of the U.S. Army Corps of EngineerÕs mitigation of fish losses from the construction of the John Day Dam.

The hatchery was in general compliance with most of the performance measures. The hatchery was in compliance with all of the performance measure for program objectives, In the area of facilities requirements, the audit found that the hatchery was not in compliance with the monitoring requirements for chemistry parameters and contaminants, adult holding facilities, rearing facilities, and release facilities. In the area of hatchery practices, the hatchery did not have specific incubation and rearing standards, was not able to water harden eggs in iodophor, and the loadings for incubation were larger than the IHOT standards. The hatchery did not have written broodstock collection plan, written spawning protocols, or a Genetics Monitoring and Evaluation Program in place.

The specific areas in which the Bonneville (Tule Fall Chinook Program) Hatchery requires remedial actions based on the IHOT performance measures are listed below. These remedial actions are listed in order of occurrence on the questionnaire without intent of ranking or otherwise assigning priority:

- Monitor total gas pressure and dissolved oxygen
- Monitor chemistry parameters, turbidity, alkalinity, hardness, and nitrite on routine basis
- Monitor contaminants on routine basis

- Modifications to adult holding to increase water flow
- Regional quality control officer to oversee production procedures and monitor feed quality
- Relocation of fish discharge point in Tanner Creek
- Develop specific incubation standards for IHOT Operations Plan
- Incubation loadings greater than listed in IHOT
- Develop specific rearing standards for IHOT Operations Plan
- Need separate water system for iodophor treated incubation systems
- Need to measure percent smoltification
- Cleaning of fish transport vehicle exterior and interior not done routinely
- Hatchery manager and evaluation biologists need better communication and documentation
- Develop spawning protocols for IHOT Operations Plan
- Develop broodstock collection plan for IHOT Operations Plan
- Develop genetics monitoring and evaluation plan for IHOT Operations Plan

Non-compliance issues resulting from items beyond human control or Performance Measures not relevant to this hatchery (Type 1 in Table 2, Section 4) were not listed above.

Section 2

Facility Description

Name:	Bonneville Hatchery
Stock/Species:	Tule Fall Chinook, URB Fall Chinook, Spring Chinook, and Coho
Operating Agency:	Oregon Department of Fish and Wildlife
Funding Agency:	Receives funding from both the National Marine Fisheries Service (NMFS) and U.S. Army Corps of Engineers (COE)
Location:	Just west of Cascade Locks, Oregon at Bonneville Dam on the Columbia River
Address:	Bonneville Hatchery Oregon Department of Fish and Wildlife Star Route B, Box 12 Cascade Locks, OR 97014
Hatchery Manager:	Mr. Dan Barrett
Phone	(503) 374-8393
Fax:	(503) 374-8090
Purpose:	Bonneville Hatchery was constructed in 1909 and was originally funded by the State of Oregon. In 1957 the facility was remodeled and expanded as part of the Columbia River Fisheries Development Program (Mitchell Act), a program to enhance declining fish runs in the Columbia River Basin. The hatchery underwent another renovation in 1974 as part of the U.S. Army Corps of EngineerÕs mitigation of fish losses from the construction of the John Day Dam.

This hatchery provides fish for the ocean and river fisheries and eggs to other programs.

Production Goal:

URB Fall Chinook

2,900,000 eggs to Umatilla Hatchery

3,030,000 fingerlings (37,875 lb) for release in the Columbia

5,325,000 smolts and fingerlings (112,750 lb) for on-station releases

2,500,000 fingerlings (41,670) for NMFS Fish by-pass study

225,000 smolts (28,125 lb) for release in the Umatilla River

Tule Fall Chinook

10,200,000 fry (34,000 lb) for transfer to Stayton Ponds

8,000,000 fingerlings (123,080 lb) for on-station releases

2,000,000 fingerlings (40,000 lb) for release in Tanner Creek from the Stayton Ponds

Spring Chinook

350,000 Carson stock smolts (32,500 lb) for release into the Umatilla River

158,000 Deschutes stock fry (1,200 lb) for transfer to Oxbow Hatchery

125,000 Deschutes stock smolts (15,625 lb) for release into the West Fork Hood River

Coho

2,000,000 smolts (153,846 lb) for on-site release

Total Production: 620,671 lb

Water Supply: Gravity supply from Tanner Creek

Wells

Facilities:

Incubation: 152 16-tray vertical incubators

60 bulk incubators (space for 10 baskets each)

Adult Holding Upper Pond (North) - 32,785 cf

Upper Pond (South) - 32,785 cf

Lower Pond - (Upper Side) - 11,288 cf

Lower Pond - (Lower Side) - 14,502 cf

Raceways Battery A - 22 converted Burrows ponds - 3,188 cf each

Battery B - 8 converted Burrows ponds - 3,188 cf each

Battery C & D - 30 raceways - 4,000 cf each

Adult Holding Ponds - 4 ponds, 91,360 cf total

Satellite Facilities None

Section 3

Compliance Status

The hatchery audits are based on compliance with written IHOT performance measures. These performance measures are documented in ***Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries*** (referred to as *IHOT 1995* in this report). The purpose of the performance measures is to implement new basinwide policies that provide regional guidelines for operating anadromous hatcheries in the Columbia Basin.

The audit focuses on performance measures for IHOT policies that cover (1) hatchery performance standards, (2) fish health, (3) ecological interaction, and (4) genetics. These performance measures are intended to guide hatchery operations once production is established. For that reason, the hatchery operations audited included broodstock collection, spawning, incubation of eggs, fish rearing and feeding, fish release, equipment maintenance and operations, and personnel training. Production priorities are beyond the scope of this audit.

Based on *IHOT 1995*, a detailed 98 page audit form was developed. The audit form divided the performance measures into six major sections along major program and technical criteria areas. Section 7 includes general information needed for the audit:

Section 1	Performance Measures for Program Objectives (PMs 1-4)
Section 2	Performance Measures for Facility Requirements (PMs 5-15)

Integrated Hatchery Operations Team (IHOT) 1995. *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries*, Bonneville Power Administration, Portland, Oregon.

Section 3	Performance Measures for Hatchery Practices (PMs 16-25)
Section 4	Performance Measures for Fish Health Policy (PMs 26-34)
Section 5	Performance Measures for Ecological Interactions (PMs 35-38)
Section 6	Performance Measures for Genetics Policy (PMs 39-43)
Section 7	Performance Measures for General Information (PMs General 1-2)

Several performance measures are repeated in various sections of the audit. These performance measures overlap in *IHOT 1995* and were retained to allow individuals interested in specific portions of the audit (such as Genetics or Fish Health) to determine the compliance status of all performance measures for a given topic in one location. A repeated performance measure is indicated by light gray shading.

The Hatchery Audit Process

The hatchery audit will be conducted over a two-year period that concludes in 1997. This report covers phase one of the audit, which consists of an audit of four hatcheries and seven species or stocks of fish. At each hatchery, a five-step process was used to complete the overall hatchery audit. This process consisted of research and on-site visits. The site visits were conducted from March 4 to March 8.

The following is the five step audit process:

1. Information was obtained from headquarters sources.

2. The hatchery manager was asked to fill out and return the **Audit Form**.

3. A 1-2 day site audit inspection visit was conducted at each hatchery. During that visit an audit team inspected facilities, reviewed hatchery records, discussed audit form responses, and developed remedial action plans when appropriate.

4. A **Compliance Report** was developed to document the compliance status of each performance measure. During the site visit, the compliance status of each performance measure was discussed with the hatchery manager and IHOT representative.

5. This information was used to develop a draft **Hatchery Evaluation Report.** Based on review and comments of this prototype document, a final Hatchery Evaluation Report was developed. The final report documents the compliance of a particular hatchery with the IHOT performance measures and presents cost estimates to correct any deficiencies.

Compliance Status of Bonneville Hatchery (Tule Fall Chinook)

This section documents the compliance status of the Bonneville Hatchery (Tule Fall Chinook). Each performance measure is presented in a table taken from the audit form (Table 1). The compliance status is identified by the following categories:

- **N/A** (not applicable)
- **Yes** (in compliance)
- **?** (unknown; generally due to unavailability of information to determine compliance)
- **No** (not in compliance).

Remedial actions are suggested for performance measures not in compliance. These remedial actions are grouped into categories and listed in Section 4, where the cost of the required remedial actions is also presented.

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#1	**Are the hatchery programs outlined in a subbasin management plan?**		4			Columbia Basin System Planning Production Plan & U.S. vs. Oregon	
#2	**Is the hatchery operating under a current hatchery operational plan?**		4			Review of IHOT Operational Plan	
	Is it understood by staff?		4			Discussion	
	Is it being followed?		4			Discussion	
#3	**Is a hatchery monitoring and evaluation plan in place?**		4			Review of Missing Production Groups Project reports	Not hatchery responsibility; need better communication/documentation
#4	**Specific performance measures include:**						
#4a	**Adult contribution to fisheries, spawning grounds and hatchery**		4			Review of records	
#4b	**Adult pre-spawning survival as compared with established goal**		4			Review of records	
#4c	**Egg-take as compared with established hatchery goal**		4			Review of records	
#4d	**Green-egg-to-eyed-egg survival as compared with established goal**		4			Review of records	
#4e	**Eyed-egg to fry survival as compared with established goal**		4			Review of records	

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

		N/A	Yes	?	No		
#4f	**Fry-to-smolt survival as compared with established goal**		4			Review of records	
#4g	**Production as compared with established goal**		4				
#4h	**Percent survival (smolt to adult) as compared with established goal**	4				No goal in IHOT Operations Plan	
#4i	**Number of eggs, fry, fingerlings, smolts and/or adults to meet basinwide needs**	4				Review of records	

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#5	**Water quality**						
#5a	**Temperature**						
	Do your water temperatures meet the criteria for spawning?		4			Average daily temperatures okÑcould be different with more data	
	Do your water temperatures meet the criteria for incubation?		4			Ò Ò	
	Do your water temperatures meet the criteria for rearing?		4				
#5b	**Dissolved gases**						
	Is the oxygen level near saturation?			4		No data	Monitor total gas pressure (TGP) and dissolved oxygen (DO)
	Is the dissolved nitrogen level less than saturation?			4		No data	
#5c	**Chemistry**						
	Ammonia (un-ionized)		4			1 sample for Tanner Creek	Run analysis for Tanner Creek and wells
	Carbon Dioxide			4		No data	
	Chlorine		4			1 sample for Tanner Creek	
	pH			4		No data	
	Copper			4		No data	
	Hydrogen Sulfide		4			1 sample for Tanner Creek	
	Iron		4			1 sample for Tanner Creek	
	Zinc			4		No data	
#5d	**Turbidity**						
	Does your turbidity meet the criteria?			4		No data	Run analysis for Tanner Creek

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

		N/A	Yes	?	No		
#5e	**Alkalinity and hardness** Does your alkalinity and hardness meet the criteria?				4	1 sample	Unknown; run analysis to confirm
#5f	**Nitrite** Does your nitrite meet the criteria?			4		1 sample - "trace"	Run analysis
#5g	**Contaminants**						
	Aldrin			4		No data	Run analysis
	Endrin			4		No data	Run analysis
	Dieldrin			4		No data	Run analysis
	Heptachlor			4		No data	Run analysis
	Chlordane			4		No data	Run analysis
	Methoxychlor			4		No data	Run analysis
	Lindane			4		No data	Run analysis
	Malathion			4		No data	Run analysis
	Guthion			4		No data	Run analysis
#5h	**Pathogens** What portions of the hatchery have disease-free water?						
	Adult holding?				4	Inspection of facilities/Discussion	Unknown
	Incubation?		4				
	Early rearing?		4				
	Rearing?			some			Unknown
	Others?						

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

		N/A	Yes	?	No		
#6	**Alarm Systems**						
	Do the following areas have alarms?						
	Intake?			4		Inspection of facilities/Discussion	
	Large rearing ponds and adult holding ponds?			4		Ò	
	Raceway headboxes and rearing ponds?			4		Ò	
	Incubation facilities?			4			
	Quarantine areas and facilities?	4					
	Water treatment systems?			4			
	Security?			4			
	Are there outside systems and buzzers in on-site residences?				4		Need to check more frequently
	Are water flow alarms checked daily?			4		Discussion Ò Ò	
	Are all other alarms checked weekly?		4				Need better alarm log
	Is there a log of alarms for emergencies, tests, and maintenance requirements				4		Not a problem
	Are telephone pagers used?					Phones are wired to residences	
#7	**Adult collection and holding facilities**						
	Do you meet the adult holding criteria?				4	Review of records/Discussion	Need modifications to adult holding facilities

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

		N/A	Yes	?	No		
#8	**Incubation facilities**						
	Type 1: Vertical Tray Do you have an adequate number of units for the overall program?		4			Inspection of facilities/Discussion	
	Type 2: Bulk Incubator Do you have an adequate number of units for the overall program?		4			Inspection of facilities/Discussion	
#9	**Rearing facilities**						
	Type 1: Rectangular Raceways Do you have an adequate number of units for the overall program?		4			Inspection of facilities/Discussion (Need to resurface 26 out of 30 raceways - - not IHOT issue)	
	Type 2 Burrows Ponds Do you have an adequate number of units for the overall program?		4			Inspection of facilities/Discussion	
	Type 3: Adult Holding Ponds Do you have an adequate number of units for the overall program?		4			Adult holding ponds used for rearing	See response to #7
#10	**Screening facilities**						
	Do you meet the approach velocity criteria:		4			Spreadsheet provided by ODF&W	
	Are the fish screens regularly cleaned?		4			Discussion	
	Are rearing containers double screened for fish that should not be released to adjacent water?		4			Inspection of facilities/Discussion	Assuming that sockeye production is moved to another hatchery

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

		N/A	Yes	?	No		
#11	**Predator control facilities** Are your predation control facilities effective?		4			Inspection of facilities/Discussion	

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

		N/A	Yes	?	No		
#12	**Food storage facilities and quality control**						
	Does the storage of dry/semi-moist/moist foods follow food manufacturerÕs recommendations? (dry<12%; semi-moist 12-20%; moist >20% moisture)		4			Discussion	
	Does a regional quality control officer oversee production procedures and monitor:					Support for these activity is being reduced	
	Verification by feed manufacturer that ingredients meet specifications?			4		Ò Ò	This needs to be done
	Ensure feeds do not contain unwanted drugs or other additives?				4		
	Analyze ingredients contained in the final food product to ensure that feed specifications have been met?		4			Discussion	
	Are the storage and handling of foods followed according to the following criteria?						
	Moist pellets should not exceed 10°F at point of delivery?		4			Ò Ò	
	Moist pellets should be removed from freezer just prior to feeding?		4				
	Do not leave buckets of feed or feed containers outside exposed to light or heat?		4				
	Open bags of feed should be fed within one to two days except when feeding small groups of fish?		4				

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

		N/A	Yes	?	No		
#13	**Release facilities** Do the release facilities ensure that fish are not subjected to adverse conditions?			4		Discussion	Fish release point should be relocated
#14	**Pollution abatement facilities** Do the pollution abatement facilities meet all federal and state regulations (or good engineering practice)? Are pollution abatement facilities operated correctly?		4 4			Inspection of facilities/Discussion Discussion	
#15	**Transportation facilities** Are the transport systems adequate to meet IHOT performance measures for transportation practices?		4			Discussion	

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#16	**Broodstock selection practices**						
	Is the donor selection process document attached?	4				Existing program; does not apply	
	Was the donor selection outline followed in selecting the hatchery broodstock?	4				Existing program; does not apply	
	Go to PM #40 in Genetics						
#17	**Spawning practices**						
	Were the appropriate number of spawners, male/female ratios, and fertilization protocols used?		4			Review of records/Discussion	
	Go to PM #42 in Genetics Section						
#18	**Incubation practices**						
	Are specific incubation standards listed in the hatchery operations plan?				4	Review of Operations Plan	Develop standards for Operation Plan
	Are incubation practices written?				4	None supplied to inspection team	
	Incubation Type 1: Vertical See PM #8) Do you meet the loading and flow criteria?				4	Loading greater than criteria	Modify operations or criteria
	Incubation Type 2: Bulk See PM #8) Do you meet the loading and flow criteria?		4			Review of records/Discussion	

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

		N/A	Yes	?	No		
#19	**Rearing practices**						
	Are specific rearing standards listed in the hatchery operations plan?				4	Review of Operations Plan	Develop standards for Operation Plan
	Are rearing practices written?				4	None supplied to inspection team	
	Rearing Unit Type 1: Rect. Raceways (see PM 9)		4			Review of records/Discussion	
	Do you meet the density and DI criteria?		4			Review of records/Discussion	
	Do you meet the Loading and FI criteria?						
#20	**Smolt quality**						
	Do you produce a high quality smolt?		4			Discussion	

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

		N/A	Yes	?	No		
#21	**Fish health management practices**						
	Are the monthly hatchery monitoring visits being conducted? (PM #26)		4			Review of records/Discussion	
	Are the annual broodstock inspections being conducted? (PM #27		4			Review of records/Discussion	
	Is there pathogen-free water and are the sanitation procedures being followed? (PM #28)		4		4	Pathogen-free water: yes; cannot water harden eggs in iodophor	Need separate water system for treated incubation water
	Are the following water quality parameters within criteria? (PM #5a-5h)		4			Review of records	
	Water temperature			4		No data	Monitor TGP/DO
	Dissolved gases			4		No data for CO_2, pH, Cu, Fn	Run analysis
	Chemistry			4		No data	Run analysis
	Turbidity				4	1 sample	Run analysis
	Alkalinity and hardness			4		"Trace"	Run analysis
	Nitrite			4		No data	Run analysis
	Contaminants						
	Are rearing standards being followed? (PM #19)		4			Review of records/Discussion	
	Are egg and fish transfer/release requirements met? (PM #31)		4			Review of records/Discussion	

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

		N/A	Yes	?	No		
#22a #22a1	**Does hatchery performance meet requirements outlined in the regional hatchery policies and in subbasin and hatchery plans for the following areas:** **Percent smoltification** Do you measure percent smoltification? Did you meet the smoltification criteria?	4			4	Review of records/Discussion No goal found	Unknown
#22a2	**Rearing density (prior to release)** Did you meet the rearing density criteria just prior to release?		4			Review of records/Discussion	
#22a3	**Disease condition (at release)** Did you meet all disease regulations just prior to release?		4			Review of records/Discussion	
#22a4	**Number (at release)** Did you meet the release number goal?		4			Review of records/Discussion	
#22a5	**Size at release** Did you meet the size goal?		4			Review of records/Discussion	
#22a6	**Dates of release** Did you meet the release date goal?		4			Review of records/Discussion	

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

		N/A	Yes	?	No		
#22a7	**Location of release** Did you the release the fish at the specified location?		4			Review of records/Discussion	
#22b	**Are fish reared in the subbasin or acclimated in the subbasin?** Are the fish reared in the subbasin? Are the fish acclimated in the subbasin?		4 4			Review of records/Discussion Review of records/Discussion	
#22c	**Is the release strategy appropriate for the program?**		4			Discussion	

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

		N/A	Yes	?	No		
#23	**Transportation facilities**						
	Do transportation equipment and personnel receive disinfection before and after use?		4			Discussion	
	Disinfection of fish tank interior using a solution of 200 ppm active chlorine for 30 minutes minimum or formaldehyde gas generation method (relative humidity of 60% for 2 hrs)?		4			Ò Ò	
	Disinfection of fish transport vehicle exterior using high pressure steam (115-130°C), high temperature acid, or with 200 ppm chlorine for 30 minutes?				4	Sometimes	
	Disinfection of fish transport vehicle (cab) using 600 ppm quaternary ammonia compounds (1.5 ml of 50% stock solution/liter water)?				4	Sometimes	
	Disinfection of other equipment including fish pumps, nets, egg sorters, waders, boots, rain gear, hoses and other equipment use one of the following solutions?		4			Discussion	
	200 ppm chlorine for 30 minutes 600 ppm quaternary ammonia compound for 30 minutes 200 ppm iodophor solution for 10 minutes		4			Review of records/Discussion	
	Do personnel wear protective garments when handling fish eggs, or cultural water?		4			Review of records/Discussion	
	Do the fish transport truck/chassis and tank/unit receive an inspection and service prior to the release season?					Review of records/Discussion	

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

		N/A	Yes	?	No		
							Modify operations
							Modify operations

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

		N/A	Yes	?	No		
#23 (cont)	**Transportation facilities**						
	Does a pre-loading inspection covering the following: tank water level, pumps or aerators, oxygen injection system settings, displacement gauge, and truck loading/hauling density tables checked and reviewed occur prior to loading the fish in the transport unit?		4			Review of records/Discussion	
	Do hauling criteria include checking the fish 45 minutes to 1 hour after loading occur?		4			Review of records/Discussion	
	When fish are active and systems are functioning properly, is the oxygen concentration reduced and maintained approximately 8 ppm?		4			Review of records/Discussion	
	Is water temperature in the transportation unit maintained within 42-48°F range?		4			Review of records/Discussion	
	Do fish releasing procedures include the following criteria?						
	Releasing the fish at the correct release site or into the correct water body.		4			Review of records/Discussion	
	Tempering or the difference between the liberation tank and the target water body should not exceed 10°F.		4			Review of records/Discussion	
	The liberation hose should be angled so that fish gently hit the water. Using a tripod is a method of ensuring the hose will stay at the proper angle.		4			Review of records/Discussion	

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

		N/A	Yes	?	No		
#24	**Evaluation practices** Has the hatchery conducted fishery contribution studies to:						
	Determine the requirements for evaluating and improving management programs?			4		Discussion	Better communication between management, biologists & hatchery
	Develop guidelines that define the geographical area and identify component stocks (hatchery and/or wild) that comprise the management unit?			4		Discussion	Ò Ò
	Develop guidelines that define if the proper stocks of fish are currently being used?		4			Discussion	
	Determine which management units contribute to a specific fishery and the time periods of those contributions?		4			Discussion	
	Determine the relative contributions of the various management units to a specific fishery over the different time periods?						

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

		N/A	Yes	?	No		
#25	**Training practices**						
	Does the hatchery have a training schedule for its staff?		4			Discussion	
	Does each staff member have a personal training plan approved by a supervisor and reviewed annually?		4			Ò Ò	
	Does the hatchery routinely exchange training details between other hatcheries and agencies?		4				
	Does the hatchery encourage and reward off-duty training of staff?		4				
	Does the hatchery conduct monthly staff meetings?		4				

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#26	**Are monthly hatchery monitoring visits being conducted by a qualified fish health specialist?**		4			Review of records/Discussion	
#27	**Are all of the functions of the hatchery yearly monitoring visits being completed as described below?**		4			Review of records/Discussion	
#28	**Is the hatchery following accepted sanitation procedures?**						
	Are there any sources of pathogen-free water, especially for incubation and early rearing?		4			Inspection of facilities/Discussion	
	Are the hatchery sanitation procedures understood and being followed?				4	Inspection of facilities/Discussion	Need separate water system for incubation treated water
#29	**Are water quality parameters being followed?**						
	Are the following water quality parameters within criteria? (PM #5a-5h)						
	Water temperature		4			Review of records	
	Dissolved gases			4		No data	Monitor TGP/DO
	Chemistry			4		No data for CO_2, pH, Cu, Fn	Run analysis
	Turbidity			4		No data	Run analysis
	Alkalinity and hardness				4	1 sample	Unknown
	Nitrite			4		"Trace"	Run analysis
	Contaminants			4		No data	Run analysis
	Go to PM #21						

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

		N/A	Yes	?	No		
#30	**Are incubation and rearing standards being followed?** Are the incubation practices being following the IHOT incubation criteria? (PM #18) Are the rearing practices following the IHOT criteria? (see PM #19) Go to Rearing practices, PM #18-PM #19		4		4	Loadings greater than criteria Review of records/Discussion	Modify operations or criteria
#31	**Are egg and fish transfer/release requirements met?**		4			Review of records/Discussion	

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#32	**Is the hatchery's program outlined in a subbasin management plan?** Go to subbasin plan, PM # 1		4			Columbia Basin System Planning Production Plan & U.S. vs. Oregon	
#33	**Is the hatchery operating under a current hatchery operational plan?** Go to operational plan, PM # 2		4			Review of IHOT Operational Plan	
#34	**Is a hatchery monitoring and evaluation plan in place?** Go to hatchery monitoring and evaluation plan PM # 3		4			Review of Missing Production Group Project reports	Not hatchery responsibility; Need better communication/documentation

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

		N/A	Yes	?	No		
#35	**Does the hatchery program meet requirements established in the regional hatchery policies and subbasin planning documents in the following areas: species, stock, broodstock collection location, broodstock numbers, broodstock collection strategy, and spawning and egg-take protocols.**						
	Does the hatchery program meet the requirements for the following: (PM #1-PM #2)		4			Review of plans	
	Species protocols? (PM #4a)		4			Review of records/Discussion	
	Stock protocols? (PM #4a)		4			Review of records/Discussion	
	Broodstock collection location protocols? (PM #41)		4			Review of protocols/Discussion	
	Broodstock numbers protocols? (PM #42)		4			Review of records/Discussion	
	Broodstock collection strategy protocols? (PM #41)		4			Review of records/Discussion	
	Spawning protocols? (PM #42)		4			Review of records/Discussion	
	Egg-take protocols? (PM #42)		4			Review of records/Discussion	

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

		N/A	Yes	?	No		
#36	**Does the hatchery's performance meet requirements outlined in the regional hatchery policies and in subbasin and hatchery plans for the following areas: percent smoltification, rearing density, disease condition, and the number, size date(s), and location at release.**						
	Percent smoltification (PM #22a1)	4				No goal found	
	Rearing density (PM #22a2)		4			Review of records/Discussion	
	Disease condition (PM #22a3)		4			Review of records/Discussion	
	Number at release (PM #22a4)		4			Review of records/Discussion	
	Size at release (PM #22a5)		4			Review of records/Discussion	
	Date of release (PM #22a6)		4			Review of records/Discussion	
	Location at release (PM #22a7)		4			Review of records/Discussion	
#37	**Are fish reared in the subbasin or acclimated in the subbasin?** See PM #22b		4			Discussion	
#38	**Is the release strategy appropriate for the program?** See PM #22c		4			Discussion	

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#39	**For new programs, has a broodstock collection plan been developed?**						
	Is the broodstock collection plan written?	4				Existing Program; does not apply	
	For a non-captive broodstock program:						
	Was an unbiased, representative sample collected?	4				Existing Program; does not apply	
	Was the recommended number of broodstock collected?	4				Existing Program; does not apply	
	For a captive broodstock program:						
	Were captive brood progeny excluded as donors for propagating the next generation of the captive broodstock program?	4				Existing Program; does not apply	
	Were full-sib crosses avoided?	4				Existing Program; does not apply	
	Is the broodstock collection plan understood and being followed by staff?	4				Existing Program; does not apply	

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

		N/A	Yes	?	No		
#40	**For a new program, was the donor selection outline followed in selecting the hatchery broodstock?**						
	Is a donor selection plan written?						
	Was the donor selection outline followed in the selecting the broodstock?	4				Existing Program; does not apply	
	Was the target stock recommended in the donor selection process actually used?	4				Existing Program; does not apply	
		4				Existing Program; does not apply	
#41	**For existing programs, were the broodstock collection procedures followed?**						
	Is the broodstock collection plan written?				4	None supplied to inspection team	Develop broodstock collection plan for Operations Plan
	Does the broodstock collection plan follow the guideline:						
	Was an unbiased, representative sample collected?		4			Discussion	
	Was the recommended number of broodstock collected?		4			Discussion	
	Were the broodstock collection procedures in hatchery operation plan understood and followed?		4			Discussion	

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

		N/A	Yes	?	No		
#42	**Were the appropriate number of spawners, male/female ratios, and fertilization protocols used?**						
	Are the spawning protocols written?				4	None supplied to inspection team	Develop spawning protocols for Operations Plan
	Are daily or weekly spawning logs available?		4			Review of records/Discussion	
	Were the appropriate number of spawners used?		4			Review of records/Discussion	
	Did you attempt to spawn all collected broodstock and randomize mating with respect to age class, and other traits?		4			Discussion	
	Was the sex-ratio within the limits given in the performance standards?		4			Discussion	
	Were the fertilization protocols followed?		4			Discussion	
	If the hatchery needed to reduce the number of eggs retained, was this done by representative sampling of each male/female cross?	4				Discussion	

Table 1 Bonneville Hatchery Compliance (Tule Fall Chinook) With Performance Measures

		N/A	Yes	?	No		
#43	**Is there a genetics monitoring and evaluation program in place?**						
	Is a genetics monitoring and evaluation program available?				4	None supplied to inspection team	Develop plan genetics monitoring and evaluation program for Operations Plan
	Does the plan address the following elements listed in IHOT:	4					
	Does the program have elements needed to meet evaluation goals 1-4?	4					
	Has a qualified geneticist reviewed and endorsed the program (goal 5)?	4					
	Will the program collect the data and maintain the records needed to evaluate compliance on an ongoing basis (goal 5)?	4					
	Is it understood and followed by staff?						

Section 4

Remedial Actions

Based on the compliance status for each performance measure, remedial actions were developed. The required remedial actions are organized into five categories. The types of categories range across a spectrum from those actions that are beyond human control to those that require a change in agency policy or procedures to those that have a significant capital cost to put in place. The following are the five types of remedial actions identified under phase 1 of the audit:

The Five Types of Remedial Actions

Type	Description
1	Non-compliance issues resulting from items beyond human control or PM not relevant for this hatchery
2	Remedial actions requiring changes in agency policies or procedures
3	Remedial actions requiring changes in monitoring coverage or interval
4	Remedial actions requiring significant capital expenditures
5	Remedial actions that may require significant capital expenditures but not clearly definable at this time

Remedial Actions at Bonneville Hatchery (Tule Fall Chinook)

This section presents the corrective actions required to bring the Bonneville Hatchery Tule Fall Chinook program into compliance with the IHOT performance measures. The remedial actions suggested here are just that, suggestions developed by the Montgomery Watson Audit Team. For some non-compliance areas, other remedial actions could be proposed. The required remedial actions are cross-referenced to each IHOT performance measure that was not in compliance. Where appropriate, the costs associated with the remedial actions are also presented (Table 2).

The cost estimates presented in this section are based on professional experience from similar projects. In most cases, only a lump-sum figure is presented and detailed take-off lists have not been prepared. The cost estimates are essentially order of magnitude estimates (± 40%).

More importantly, the suggested remedial activities may also present several levels of action. Optional actions have been listed for several problems. These optional actions are desirable for either operational or safety considerations.

Table 2. Remedial Actions Required at Bonneville Hatchery (Tule Fall Chinook)

Remedial Action Required	Cost	PMs[1]
Type 1 - Non-compliance issues resulting from items beyond human control or PM not relevant for this hatchery		
Telephone pagers are not used (Not a problem, phones are wired to residences)	-----	6
Type 2 - Remedial actions requiring changes in agency policies or procedures		
Regional quality control officer to oversee production fish feed procedures and monitor feed quality	-----	12
Develop specific incubation standards for IHOT Operations Plan	-----	18
Incubation loadings greater than listed in IHOT	-----	18
Develop specific rearing standards for IHOT Operations Plan	----	19
Need to measure percent smoltification	----	22a1
Cleaning of fish transport vehicle exterior and interior not done routinely	----	23
Hatchery manager and evaluation biologists need better communication and documentation	----	24
Develop broodstock collection plan for IHOT Operations Plan	----	41
Develop spawning protocols for IHOT Operations Plan	----	42
Develop genetics monitoring and evaluation plan for IHOT Operations Plan	----	43

Remedial Action Required	Cost	PMs[1]
Type 3 - Remedial actions requiring changes in monitoring coverage or interval		
Monitor total gas pressure and dissolved oxygen (instruments only)	$4000	5b,21, 29
Monitor chemistry parameters, turbidity, alkalinity, hardness, and nitrite on routine basis	$200/year	5c,5d, 5e,5f,29
Monitor contaminants on routine basis	$400/year	5g
Type 4 - Remedial actions requiring significant capital expenditures		
Modifications to adult holding to increase water flow and relocation of fish discharge point in Tanner Creek (design has been completed for these items)	$2,300,000	7,13
Need separate water system for iodophor treated incubation water (costs will depend strongly on operational constraints and safety considerations that would be determined in design)	$150,000	21
Type 5 - Remedial actions that may require significant capital expenditures but not clearly definable at this time		
None		

Section 5

Hatchery Contribution to Fisheries, Spawning Grounds and Hatcheries

This section presents the audit findings for the Bonneville HatcheryÕs Tule Fall Chinook contribution of adult fish to fisheries, spawning grounds, and hatcheries. Data is reported by broodyear. A broodyear refers to the adult contribution from the eggs produced from a single group of spawning adults. For some species, this may include fish caught as 2, 3, 4, 5, and 6-year old fish. Because of the return distribution and data processing delays, the complete adult contribution for a given broodyear may not be available until 4-5 years after the fish have been released from the hatchery.

Table 3. Adult Contribution to Fisheries, Spawning Grounds, and Hatcheries - Bonneville Hatchery (Tule Fall Chinook)

Year	Fisheries[3] (Broodyear)	Spawning Grounds[3] (Broodyear)	Hatchery (Broodyear)	Smolt to Adult Survival (percent)
1981				
1982				
1983				
1984				
1985				
1986	9,652	----	5,174	0.15
1987	1,601	----	420	0.02
1988	1,5029	----	10,574	0.22
1989	5,779	----	3,918	0.15

Data obtained from Missing Production Groups Annual Reports or from the Regional Mark Information System database.

1990				
1991				
1992				

Section 6

Annual Operating Expenditures

The level and detail of annual operating expenditures varies widely depending on hatchery, operating agency, and funding source. When provided, expenditures were presented in terms of personnel costs, operating costs (power, feed, supplies), capital costs, indirect costs charged to the Federal government, third-party costs, and other costs. These cost components were summed to determine a total hatchery annual cost. Based on discussion with the hatchery manager, the percent of total hatchery costs allocated to a given program were estimated. The total hatchery costs and the percent of hatchery costs allocated to a given program were used to compute the cost of a given program. Table 4 shows the annual operating expenses for the Bonneville Hatchery (Tule Fall Chinook).

Table 4. Annual Operating Expenses - Bonneville Hatchery (Tule Fall Chinook)

Component	1992	1993	1994
Personnel Costs[4]			
Operational Costs[4]			
Capital Costs[4]			
Indirect Costs[4]			
Lumped Hatchery Costs[5]	$1,039,530	$1,010,404	$1,112,305
Lumped Third Party Costs[6]	$300,000	$300,000	$300,000
Total Hatchery Costs	**$1,339,530**	**$1,310,404**	**$1,412,305**
Source of Funds			
NMFS	55%	55%	55%
COE	45%	45%	45%
Program Production (lb)	---	---	---
Total Production (lb)	---	---	---

Program as Percent of Total	55%	55%	55%
Program Costs	**$686,742**	**$670,722**	**$726,768**

[4] The levels of detail for expense information was expanded after the Phase 1 data collection process was completed. This table will be updated at the completion of Phase 2.

[5] If it was not possible to obtain a detailed cost breakdown from an agency or third party, the undivided costs were entered here.

[6] 20 million kWh/year at an assumed costs of $0.015 per kWh; provided by COE

PMs are Performance Measures that were extracted from the IHOT 1995 report. The IHOT Performance Measures are listed in Table 1 in Section 3 in numerical order.